UNITED NATIONS **E/CONF.100/CRP.2**

ECONOMIC AND SOCIAL COUNCIL

Eighteenth United Nations Regional Cartographic Conference for Asia and the Pacific
Bangkok, 26-29 October 2009
Item 7(a) of the provisional agenda
Country Reports

Geospatial Information in Japan*

* **Prepared by the Government of Japan**

Geospatial information in Japan

Government of Japan

Most of the Geospatial information in Japan is carried out under the Survey Act. Main objectives of the act are to coordinate various survey works efficiently, to standardize accuracy and to avoid duplicated work.

Geospatial information is mainly classified into two categories by the act. The first one is the Fundamental Survey executed nationwide by the Geographical Survey Institute (GSI), and the other is the Public Survey for local governmental projects or special projects which are carried out by other governmental or public organizations such as the Forestry Agency, the Geological Survey of Japan/ National Institute of Advanced Industrial Science and Technology (GSJ/AIST), and the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), etc.

Preparation of various kinds of charts and nautical publications is carried out by the Hydrographic and Oceanographic Department (HOD) of the Japan Coast Guard.

Geographical Survey Institute of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT)

1. Improving and Providing Geospatial Information on the Nation's Infrastructure

The GSI establishes Japan's positional reference framework. Based on the framework, the GSI improves geospatial information on the nation's land, such as topography and buildings, and provides it to the public. Such information is essential for administrative, social and economic activities.

1.1 Formulating a national reference framework

The GSI defines positional datum of Japan, such as longitude, latitude and elevation, based on geodetic and astronomical observations.

1.1.1 Development of references for longitude and latitude

Horizontal Datum was established in 1892 as the basis of positioning in Japan by means of astronomical surveys using stars. Triangulation points have been established nationwide through triangulation surveys from the Horizontal Datum Origin. In April 2002, the GSI abolished the old Japan Geodetic System, which was uniquely used in Japan, and adopted the World Geodetic System widely used around the world as the national standard. In this system, the longitude and latitude of the Japan horizontal datum have been precisely calculated by means of VLBI (Very Long Baseline Interferometry) observations conducted within the framework of international joint observations.

Moreover, the GSI has constructed a structured geodetic reference framework based on the observations from domestic VLBI observation stations and GPS-based control stations, and has obtained the latitude and longitude coordinates of triangulation points.

1.1.2 Development of references for elevation

1.1.2.1 Reference for leveling survey – Height Datum –

The original benchmark in Japan was established in 1891 based on observations of the mean sea level in Tokyo Bay. "Zero" indicated by the crystal gauge scale was defined as an altitude 24.5000 meters. However, this was redefined as 24.4140 meters due to the crustal movement induced by the Great Kanto Earthquake

of 1923. Today, the GSI monitors changes in height through nationwide tidal observations at 25 tidal stations including Aburatsubo Tidal Station in Miura City, Kanagawa Prefecture and repeated observations of the leveling route, which extends about 20,000 kilometers all over Japan.

1.1.2.2 Reference for elevation for GPS surveys –geoid –

The GSI has been providing the precise geoid model throughout Japan with accuracy of 10cm. Almost all the land areas of Japan have been covered except some islands.

1.2 Building systems by which everyone can determine their geographical position

1.2.1GPS Observation Stations (GEONET)

GPS observation is a large part of satellite positioning of the GSI. The GSI has established 1,240 (as of April 2009) continuous GPS observation stations (GEONET) at 20-km intervals all over Japan. The observation data are publicly available for surveying including mapping, cadastral investigations, land-use planning, and other purposes. Moreover, their dense network plays a main role in monitoring and research of crustal deformations in Japan.

1.3 Carrying out observations for maintenance of the Japan National Control Network

1.3.1 Observation of geomagnetism

The observation of geomagnetism allows us to determine the geographic distribution and its secular variation all over Japan. These data are also used to monitor volcanic activity.

1.3.2 Observation of gravity

The GSI has been conducting periodical absolute and relative gravity surveys throughout Japan. Those data are used for the establishment of the gravity reference (Japan Gravity Standardization Net) as well as the detection of crustal movement.

1.4 Providing up-to-date map information via the Internet

Maps that accurately represent current land conditions are indispensable for land administration by the government and various socioeconomic activities. The use of ICT(Information and Communication Technology)-based maps is growing widespread and demand for digital maps of a larger scale is growing. With the enactment of the Basic Act on the Advancement of Utilizing Geospatial Information in May 2007, the GSI started improving a new common infrastructure, the Digital Japan Basic Map, in addition to starting work on improving and providing fundamental geospatial data.

1.4.1 Fundamental Geospatial Data

Fundamental geospatial data are reference information on which the positions of geospatial information are based. They are common outline map data that anyone can use via the Geographic Information System (GIS). Since 2007, the GSI has been seamlessly integrating large-scale map data prepared by various organizations to produce fundamental geospatial data, and providing them via the Internet free of charge.

1.4.2 Digital Japan Basic Map

The Digital Japan Basic Map integrates geographical information on Japan with the help of map information that conforms well with fundamental geospatial data and ortho image using digital aerial photographs. As it integrates information digitally, it can satisfy needs of various users and higher requirements, including national land management and disaster prevention.

1.5 Providing base maps, etc. with updated topographic/planimetric features

The GSI is constantly collecting information of changes to topographic/planimetric features and its information are expressed and provided in various scale maps etc. The information is utilized by other public/private organizations as Japan's basic geospatial information for creating various kinds of maps. The GSI also surveys superficial measures of prefectures and municipalities nationwide and publishes the survey results

1.5.1 Maps in various scales

Maps are provided based on the Digital Japan Basic Map with selected information depending on scale.

1.5.2 Digital Maps

A variety of digital maps, including vector data of roads, railways and rivers, elevation data and map images are published on CD-ROM for use with such systems as GIS.

1.5.3 Aerial photographs

The GSI takes and provides aerial photographs of plains and isolated islands throughout Japan about once every five years for the proper management, maintenance, and utilization of national land.

1.6 Managing and providing the map archives of invaluable land records

Base maps and aerial photographs are irreplaceable precise records of land features at different times. The GSI has digitalized the massive amount of existing geospatial information saved in our archives, and has made them available to anyone.

1.6.1 Old topographic maps

The GSI maintains archives of 1:25,000 and 1:50,000 topographic maps, beginning with the early 1900s.

1.6.2 Archives of aerial photographs

The GSI stores a series of aerial photographs from the postwar era to the present day, including aerial photos taken just after the end of World War II by the U.S. armed forces. Some of them can be seen on the Internet.

1.6.3 Browsing and transcripts

Anyone can browse the control data list (coordinates of control points) and past/present maps and aerial photographs, and/or receive transcripts of such documents from the GSI (main office) and regional survey departments.

2. Enhancing Utilization of Geospatial Information

As the administrative agency in charge of surveying and mapping, the GSI is promoting policies to support the development of the nation's life in cooperation with the relevant organizations in business, academia, and government.

2.1 Taking the lead in developing measures for the Advancement of Utilizing Geospatial Information

2.1.1 Planning and formulation of government policies on geospatial information

The government is working to develop a society in which geospatial information is utilized extensively under provision of the Basic Act on the Advancement of Utilizing Geospatial Information enacted in 2007.

The GSI is playing the primary role in the government in terms of policy coordination among relevant ministries and agencies, notification to local government offices, deliberations with the private sector, and formulation of the GIS Action Plan for the Advancement of Utilizing Geospatial Information.

2.1.2 Basic Plan for the Advancement of Utilizing Geospatial Information and G-Spatial Action Plan

The Basic Plan for the Advancement of Utilizing Geospatial Information approved by the cabinet in April 2008 specified the period up to FY2011 as the preparatory period to build a society in which everyone can use geospatial information and get precise information based on sophisticated analysis anytime and anywhere through the utilization of GIS and Space-based PNT(Positioning, Navigation and Timing). To promote measures formulated in this basic plan, the Action Plan for the Advancement of Utilizing Geospatial Information (G-Spatial Action Plan) was enacted in August 2008. Under the G-Spatial Action Plan, the GSI is carrying out a number of diverse important measures including the improvement, updating, provision, and standardization of geospatial information such as fundamental geospatial data.

2.2 Standardizing survey methodology to ensure order and accuracy of geospatial information

Public surveys are executed either by national organizations or local governments, and account for the majority of surveys conducted in Japan. The GSI provides guidance and coordinates survey operations in accordance with the Survey Act to ensure the accuracy of survey results and to avoid redundancy.

2.2.1 Systems for licensing surveyors and assistant surveyors

As a member of a licensing system authorized by the Japanese government, the GSI operates and manages the system for licensing surveyors and assistant surveyors. Surveyors prepare survey plans and execute surveys, while assistant surveyors carry out the plans of surveyors. Only registered surveyors or assistant surveyors are approved to engage in basic surveys and public surveys defined in the Survey Act as survey engineers.

2.2.2 Formulation of technical standards for surveys

The rules for operation (hereafter, Rules) specify the methods to be followed when conducting public surveys were revised under the initiative of the GSI. This revision should facilitate the implementation of updated methods and also improve the availability of public survey results in digital format and the development of fundamental geospatial data.

Moreover, survey planning authorities can apply these Rules to their operations. The

GSI promotes the mutual utilization of public survey results through generalization of operations under these Rules (Article 34 of the Survey Act).

2.2.3 Guidance and advice of public surveys

The GSI examines plans for implementing public surveys submitted by public survey planning authorities to ensure the required accuracy and to avoid redundancy with other public surveys based upon the rules and gives technical advice for the plans, under provision of Article 36 of the Survey Act.
The GSI also promotes extensive utilization of the results of public surveys by, for example, posting them or the publicity accessible the GSI Web site.

2.3 Preparing a system to promote the utilization of geospatial information

2.3.1 Formulating guidelines for geospatial information

Clarifying rules for smooth provision and distribution is necessary to promote the utilization of geospatial information. The GSI researches and examines the handling of maps and aerial photographs to formulate guidelines for protecting personal information and managing intellectual property rights, and the utilization of spatial information from the viewpoint of national security.

2.3.2 Simplification and rationalization of procedures, and the one-stop service for utilizing survey results

Following the revision of the Survey Act in May 2007, the GSI has been simplifying and rationalizing the procedures for utilizing survey results as it has limited the scope of purpose for reproduction subject to approval. Furthermore, the GSI is now promoting the use of the one-stop service to submit applications for reproducing and utilizing public survey results. These applications used to be submitted individually to survey planning authorities of local governments, but the GSI now accepts them collectively via the Internet.

2.3.3 Directory Search Service for Geospatial Information

The GSI operates the Geographic Information Clearinghouse, through which users can search a number of nodal databases managed by various government bodies in Japan, and see the results as metadata that describe specifications and suppliers of geospatial information.

2.3.4 Working with Local Governments

The GSI has been holding seminars on GIS utilization and geospatial information standardization to encourage the staff of local governments to use GIS and digital maps to improve the efficiency of the administrative work.

2.4 Facilitating the smooth distribution of geospatial information by providing Fundamental Geospatial Data

2.4.1 Improving, updating, and utilizing Fundamental Geospatial Data

Fundamental geospatial data are improved and updated in cooperation with national and local governments. They enables the GSI to provide up-to-date and high-precision information by managing information collectively. In addition, by utilizing a common foundation of map information, and cooperating with business, academia and government, improvement in efficiency and advancement of administration, as well as the creation of new industries and services are expected.

2.5 Encouraging transmission/receipt of geospatial information through the *Denshi Kokudo* Web System

2.5.1 *Denshi Kokudo* Web System

The GSI develops and supplies the *Denshi Kokudo* Web System. With the system the GSI provides background maps, the users can utilize adding their original information (geospatial information) on the maps via the Internet free of charge. In addition the users can utilized as the tools to create guide map on Web sites, and the national organizations and local governments can create GIS and publish information for sharing them.

2.6 Supporting the development of an infrastructure for building an ubiquitous society

2.6.1 Improving infrastructure utilizing IC tags

The GSI is conducting research on technology that enables people to locate their position using IC (Radio frequency identification) tags outdoors, indoors, or underground. It also is building a network of intelligent control points − national control points with IC tags − for the utilization of sophisticated positional information, uniform maintenance of national control points, and increased efficiency of survey operations. Through the development of these new technologies using IC tags, the GSI is building an environment in which everyone can locate their position anywhere in Japan.

2.6.2 Support for the preparation of the drafts in tactile maps

The GSI has developed the "system for preparing drafts in tactile maps" (Windows version) that enables the visually handicapped to obtain geographical information around them, and has been releasing the system on its Web site （http://zgate.gsi.go.jp/shokuchizu/） since September 2006.

3. Providing Geospatial Information for Natural Disaster Management – Realization of a Safe and Secure Society –

As a designated administrative organization pursuant to the Basic Disaster Countermeasures Act, the GSI promotes disaster mitigation measures incorporating the latest technologies of surveying and mapping.

3.1 Monitoring crustal movements and analyzing disasters risks

3.1.1 Continuous monitoring crustal movements through GPS observation Stations

The GSI operates a nationwide GPS observation network and continuously monitors all over Japan in order to detect crustal movements.

3.1.2 Mobile observation

The continuous remote GPS monitoring system (REGMOS) has been temporarily set up to collect detailed data on crustal movements from volcanic activities, etc.

3.1.3 Spatial monitoring of crustal deformations by SAR sensors onboard a satellite

SAR (Synthetic Aperture Radar) is a remote sensing technique that images the terrain and its structure by transmitting radar waves from a satellite etc., and receiving reflections from the ground.

The GSI monitors the deformations on the ground caused by earthquakes, volcanic activities, ground subsidence and landslides by InSAR (Interferometric SAR) , making

use of the data from observations by the Advanced Land Observation Satellite(ALOS) "Daichi" and other means.

3.1.4 Secretaryship of the Coordinating Committee for Earthquake Prediction and the Earthquake Research Committee

The Coordinating Committee for Earthquake Prediction was founded in April 1969, in accordance with an approval by the Cabinet and with a proposition by the National Council for Geodesy in Japan. Recognized that crustal deformation data mainly obtained through repeated geodetic surveys are very important for earthquake prediction, the GSI has been in charge of its secretariat. In this committee, researchers of universities and government organizations involved exchange their opinions and information, and examine monitoring data and methods for earthquake prediction. Moreover, the GSI, together with the Japan Meteorological Agency and the Ministry of Education, Culture, Sports, Science and Technology, serves as the secretariat of the Earthquake Research Committee of the Headquarters for Earthquake Research Promotion. The Committee is the official government body for collecting, arranging, and analyzing earthquake-related observation, survey, and research results and for comprehensively evaluating earthquake activity.

3.2 Preparing landform information for disaster mitigation

3.2.1 Thematic maps for disaster mitigation

The GSI helps people to live safer lives and to take measures to mitigate potential damage from disasters, by providing precise geospatial information on land formation processes and the locations of active faults.

3.2.2 3-D digital models for basic geospatial data

The GSI carries out Airborne Laser Surveys for major urban areas of Japan to provide high-precision, high-resolution elevation data. The data are used as basic materials for compiling hazard maps that identify areas that are vulnerable to floods and storm surges.

3.2.3 Hazard Mitigation Web Portal

On the portal site, the GSI and other departments of the Ministry of Land, Infrastructure, Transport and Tourism release various hazard maps and geographic information for disaster mitigation prepared by local governments. The site offers the one-stop service that everyone can use to search and browse for such information on the Internet.

3.3 Surveying the extent of disaster and providing the information

3.3.1 Emergency aerophotography and provision of orthophoto maps

Aerial photographs provide crucial data for making accurate and comprehensive assessments of the damage in the event of a large-scale disaster such as a major earthquake. The GSI survey aircraft "Kunikaze II" flies over affected areas to take aerial photographs, which are distributed to the relevant authorities without delay. When the Iwate-Miyagi Nairiku Earthquake in 2008 occurred, the orthophoto maps were prepared immediately after the emergency aerial photographs were taken.

3.3.2 Airborne SAR observations

When it is difficult to take pictures as a result of smoke around the volcanic crater, the observations can be made by using a radar (electromagnetic wave) sensor mounted in an airplane.

3.3.3 Provision of disaster information using the *Denshi Kokudo* Web System

Following the Iwate-Miyagi Nairiku Earthquake in 2008, the GSI investigated and collected damage information and complied as an information-intensive map, then provided via the *Denshi Kokudo* Web System.

3.3.4 Providing maps to the related organizations for disaster mitigation

After a disaster such as an earthquake occurs, the GSI immediately provides maps online or in print to help to collect information, implement emergency measures, and support recovery and reconstruction.

4. Maximizing Technology's Contribution to the International Community – Taking the Lead in Promoting International Cooperation –

The GSI plays an international role as the only administrative organization of the Japanese government involved with the survey of national land.

4.1 Improving "Global Map" as the world's fundamental geospatial information

4.1.1 Global Map

Since 1992, when the Ministry of Construction (the present Ministry of Land, Infrastructure, Transport and Tourism) proposed "Global Map," the GSI has been working with the National Mapping Organizations of many countries in the world to promote the Global Mapping Project. The purpose of the project is to develop a worldwide digital map that is needed for analyzing problems including global environmental concerns and the occurrence of large-scale disasters, and to determine measures to cope with such problems. In 2008, Global Map version 1 (Global Land Cover and Percent Tree Cover) was released. As of January 2009, 164 countries and 16 regions in the world are participating in this project.

Since the project's inception, the GSI has played a central role in promoting it, and hosting the Secretariat of the International Steering Committee for Global Mapping (ISCGM), which monitors and facilitates the progress of the project.

4.2 Taking a leading role in developing geospatial information technologies in cooperation with other countries

4.2.1 Standardization of geospatial information

In order to ensure the convertibility of GIS data, the GSI participates in the General Assembly of ISO/TC211 Geographic information/Geomatics, thus making a significant contribution to the adoption of international standards for geospatial information. Moreover, the GSI develops and promotes domestic standards that are compatible with international standards.

4.2.2 Promotion of international observation activities

The GSI promotes international projects of joint observations and research. For instance, the GSI participates in the International VLBI Service aiming at the conservation of the global environment and the elucidation of diverse geoscientific phenomena through VLBI observations. The GSI also participates in the International GNSS Service (IGS) through GPS observations.

4.2.3 Monitoring crustal deformation in the Asia-Pacific region

In order to promote disaster prevention/reduction in collaboration with other countries of the Asia-Pacific Region, the GSI has constructed a network for observation using space geodesy technology. This network is being used to monitor

crustal deformations caused by plate motion and to elucidate the mechanism of earthquakes.

4.2.4 Antarctic observations

Since 1956, the GSI has been involved in the missions of the Japanese Antarctic Research Expeditions, and has carried out geodetic and other observations. Conventional and photo maps in various scales are provided to the world in order to assist other countries with survey and research. Additionally, based on the decision of the Special Committee on Antarctic Research in 1965, Japan has been conducting topographic surveys mainly focused on a fan-shaped area between 30°E and 45°E.

Hydrographic and Oceanographic Department (HOD) of MLIT

1. Geodetic Work

Fundamental geodetic works in Japan are principally executed by the Geographical Survey Institute (GSI) and the Hydrographic and Oceanographic Department (HOD).

1.1 Satellite Positioning

HOD has been carrying out EGS (Experimental Geodetic Satellite, nicknamed "AJISAI") observation since 1986. Observations of EGS are carried out also by JAXA and GSI.

In order to measure the precise position of the mainland and islands of Japan in the World Geodetic System, HOD has been conducting a satellite laser ranging (SLR) observation of LAGEOS at the Shimosato Hydrographic Observatory since 1982, and has determined the positions of more than 70 off-lying islands using differential techniques of NNSS since 1974 and GPS since 1994.

HOD has determined the precise position of 9 islands by carrying out simultaneous SLR observation of AJISAI using portable laser ranging system HOD studied the plate movement around Japan Islands by repeated observations of our geodetic control points which include Chichi Shima, Ishigaki Shima, Tsushima, and Wakkanai.

Both of these SLR observations are supported by the cooperative research provided by the U.S.A-Japan and other cooperation in the field of space development.

In order to watch the middle size crustal deformation (about 50km), HOD continuously monitors the baselines in the Minami Kanto area, known as the nest of big earthquakes, by GPS geodetic survey in Izu Oshima, Manazuru, Yokosuka, Minami Izu, Kozu Shima, Miyake Shima and Hachijo Shima.

HOD has been conducting GPS geodetic survey to detect the crustal deformation at the Japanese coastal area.

1.2 Astronomical Observation

For the purpose of preparing the Japanese Ephemeris (the most precise almanac in Japan), nautical almanac, abridged nautical almanac, etc., HOD had been conducting observation of occultation of stars by the moon at the hydrographic observatories at Tokyo, Shirahama, Shimosato and Bisei until March 2008 when astronomical observation carried out by HOD itself had been phased out.

1.3 Gravity Survey

Gravity Surveys are executed on land by GSI and at sea by HOD.

HOD has been conducting the gravity surveys at sea area using survey vessels for prediction of earthquake and volcanic eruptions.

1.4 Geomagnetic Survey

HOD is regularly conducting geomagnetic surveys over the Japanese islands and its surrounding waters using survey vessels and aircraft for the purpose of determining magnetic variations and its annual changes which must be shown on the nautical and aeronautical charts.

HOD is also conducting the magnetic surveys for prediction of earthquake and volcanic eruptions.

1.5 Unmanned/manned Survey Launches

HOD has two unmanned/manned survey launches, "JINBEI" and nicknamed "MANBO Ⅱ", to investigate submarine volcanoes. "JINBEI" was launched in 2002. "MANBO Ⅱ" was constructed as a survey launch of survey vessel "SHOYO" in 1998. They can be operated in unmanned remote-controlled mode in the dangerous area.

1.6 The Earthquake Prediction Program

HOD surveys for the earthquake prediction program. In order to obtain data and information necessary for the prediction of earthquakes, magnetic and gravity surveys were conducted in specific areas, like plate boundaries. Total intensity magnetic anomaly and free-air gravity anomaly maps were made for elucidation of sea-bottom structure. Free-air gravity anomaly is also used to calculate precise geoid.

HOD has been carrying out seafloor geodetic observations using the GPS/Acoustic combination technique since 2000. 16 seafloor geodetic reference points have been deployed by 2005 mainly on the land-ward slope of the major trenches, such as Japan Trench and Nankai -Trough. The primary purpose is to detect and monitor the seafloor crustal movement affected by the subduction of oceanic plates. Observed results show the positioning precision of several centimeters. A time series of horizontal coordinates of a reference points off Miyagi prefecture has given an intraplate crustal velocity of about seven centimeters per year towards the WNW.

Furthermore, another reference point off Miyagi prefecture has detected a crustal movement of as large as 10 centimeters associated with the 2005 Off Miyagi Prefecture Earthquake (M7.2). After that, no remarkable crustal movement of the reference point has been detected until late 2006, and we have obtained the crustal velocity of the reference point of 6.5cm/yr towards the WNW from observation during 2007-2009.

Table 1. Geodetic Work for the Period from FY2006-2008

		2006	2007	2008	Total
Satellite Laser Ranging	Mainland	Since1982			1
GPS	Islands/land	12	12	12	36
Gravity Survey	Sea	3	1	0	4
Geomagnetic Survey	Sea	0	0	0	0
Aeromagnetic Survey	Land/Sea	1,100	250	900	2,250

*In all tables in this report, year represents Japanese fiscal year which starts from April of the year and ends in March of the next year.

*Numbers in the table mean the number of surveyed points unless otherwise specified.

2. Hydrographic Work

2.1 Hydrographic Surveying and Charting

a) The number of various hydrographic surveys carried out is as follows:

Table 2. Hydrographic Surveys FY2006-2008

Type of survey	2006	2007	2008
Harbor	2	1	1
Updating	228	179	224
Coastal	4	6	9

b) The results of these surveys were used for production of nautical and other charts, as shown in Table 3.

Table 3. Nautical and Other Charts FY2006-2008

Type of chart		2006	2007	2008
New Charts	Nautical charts	2	24	34
	Miscellaneous charts	3	0	0
	Basic Maps of the Sea	0	0	0
	Aeronautical charts	0	0	0
New Editions	Nautical charts	104	108	77
	Miscellaneous charts	3	0	2
	Basic Maps of the Sea	0	0	0
	Aeronautical charts	4	2	3
Reprints		12	74	30
Total		128	208	146

The Basic Maps of the Sea (BMS) currently produced are classified as follows:

Table 4. Classification of BMS

Series	Scale	Coverage	Size	Type
BMS in Coastal Waters	1:10,000 1:50,000	Within 12M of the coast	Full 1/2	Bathymetry; Submarine structure
BMS on Continental Shelf Areas	Mainly 1:200,000	Continental margin	Full	Bathymetry; Submarine structure; Total magnetic intensity; Gravity anomaly
BMS in Ocean Areas	1:3,000,000	Ocean Area	Full	do. (except Submarine structure;)

c) The number of paper charts issued as of April 2009 is shown below:

Table 5. Number of Paper Charts Issued

Type of Chart	Number of Issues
Nautical charts	740
Miscellaneous charts	93
Basic Maps of The Sea	459
Aeronautical charts	26
Total	1,318

Note: The International Charts of the International Hydrographic Organization (IHO) under the responsibility of Japan as the produce nation, i.e. six of the 1:3,500,000

series and two of the 1:10,000,000 series have been published.

d) Electronic Navigational Charts (ENCs)

Table 6. Number of ENCs Issued as of April 2009

Type of Chart	Number of Issues
Electronic Navigational Charts	743 cell

Note: The kinds of cell are 25 Degree,8 Degree,4 Degree,1 Degree,30 Second and 15 Second.

2.2 Other Publication Activities

Table 7. Other Publications of 2006-2008

Type of publication			2006	2007	2008
New publications	Sailing Directions	(Japanese)	1	1	1
		(English)	1	1	1
	Special publications		5	5	5
New Editions	Sailing Directions	(Japanese)	5	5	4
		(English)	4	4	4
	Special publications		4	2	4

2.3 Marine Survey

a) Survey of coastal Area

In order to cope with the establishment of 200-mile exclusive economic zone (EEZ) in accordance with the United Nations Convention on the Law of the Sea (UNCLOS), HOD is carrying out detailed surveys of low-water lines, topography and geological structure of the sea-bed in coastal area, particularly in those important areas around baseline defining the Japanese territorial sea. Japan concluded UNCLOS in 1996.

b) Airborne Laser Hydrography

HOD has been carrying out airborne laser hydrography operations since 2004 for the mapping of very shallow waters.

c) Survey of Continental Shelf Areas

HOD is carrying out hydrographic surveys south of Japan by using the large-type survey vessel "TAKUYO" and "SHOYO" equipped with modern survey instruments such as multi-beam echo sounder in order to obtain basic data required for the promotion of utilization and development of the continental shelf of Japan.

d) Surveys for Earthquake Prediction Program

HOD surveys for the earthquake prediction program. In order to obtain data information necessary for the prediction of earthquake, HOD has been carrying out surveys and investigations for submarine topography and/or active sea-bottom structures at specific areas off Miyagi and near Nankai trough.

3. International Activities

3.1 International Hydrographic Organization (IHO)

IHO Commissions, Committees and Working Groups in which Japan (HOD) has been participating are as follows:

a) Hydrographic Service and Standard Committee (HSSC)

b)Transfer Standard Maintenance and Application Development Working Group (TSMAD)

c) Data Protection Scheme Working Group (DPSWG)

d) Standardization of Nautical Publications Working Group (SNPWG)
e) Chart Standardization and Paper Chart Working Group (CSPCWG)
f) Data Quality Working Group (DQWG)
g) Marine Spatial Data Infrastructure Working Group (MSDIWG)
h) Tide and Water Level Working Group (TWLWG)
i) ENC Updating Working Group (EUWG)
j) IHO-IAG Advisory Board on the Law of the Sea (ABLOS)
k) East Asia Hydrographic Commission (EAHC)
l) Hydrographic Committee on Antarctica (HCA)
m) World Wide Navigational Warning Service Sub-Committee (WWNW-SC)
n) Capacity Building Sub-Committee (CBSC)
o) Joint IHO-IOC Guiding Committee for the General Bathymetric Chart of the Oceans (GEBCO)
p) GEBCO Technical Sub-Committee On Ocean Mapping (TSCOM)
q) GEBCO Sub-Committee on Undersea Feature Names (SCUFN)
r) Finance Committee (FC)
s) Working Group on the Revision of S-23 (Limits of Oceans and Seas) (S-23WG)
t) IHO Legal Advisory Working Group (LAWG)

3.2 Intergovernmental Oceanographic Commission (IOC)

HOD has also been working as a member of IOC which is the subsidiary body of UNESCO and has been participating in international joint projects are as follows:

a) International Oceanographic Data and information Exchange (IODE) National Coordinator
b) International Bathymetric Chart of Western Pacific (IBCWP)
c) North East Asian Regional GOOS (Global Ocean Observing System)/Co-ordinating Committee (NEAR-GOOS)
d) IOC Sub-Commission for the Western Pacific Region (WESTPAC)
e)Ocean Data & Information Network for the Western Pacific Region (ODIN-WESTPAC)

3.3 International Lunar Occultation Centre

HOD conducts astronomical works under international cooperation and makes efforts to improve the accuracy of ephemeris. HOD had been conducting International Lunar Occultation Centre (ILOC) to collect and analyze observations all over the world in a homogeneous manner until March 2009 when HOD returned the function of ILOC to IAU.

Ministry of Land, Infrastructure, Transport and Tourism (MLIT)

1. National Land Survey

The National Land Survey of Japan has been carried out under the direction and guidance of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT). The objective of the survey is to contribute to the promotion of effective use and conservation of national land. To reveal the present condition of national land, such as land ownership and its utilization, is another objective of this survey. It is expected to be based on the National Land Survey Act which was enacted in 1951, when the survey was initiated. This survey had not been promoted well, and in an attempt to do so, the acceleration Act, named The Act on Special Measures for Promotion of the National Land Survey was enacted in 1962. Three major items form the core of this survey; the land classification survey, the water use survey and the cadastral survey.

1.1 Land classification Survey and Water Use Survey

A land classification survey is the survey of the topographical and geological features, soil, and present land use. A water use survey aims at investigating the basic statistics of a river, such as annual rainfall, discharge, present water utilization for farming or drinking and groundwater.

The above mentioned surveys are compiled into maps and books as follows:

a) Land classification maps (Topographical classification map, Surface geology map, Soil map, Present land use map, and Land use capability classification map) and an Explanatory data book.
b) Geological cross section map in urban area.
c) Water use and facilities (rainfall observation facilities, sluice gates, hydroelectric power station, etc.) map and information on major river system.
d) Groundwater map and ledger of well.

1.2 Cadastral Survey

The cadastral survey aims at clarifying the location, boundary, ownership, lot number, area of lot, and status of land use of each parcel. In Japan, the cadastral survey is mainly carried out by local municipalities. MLIT plays a role in the survey by giving a 50% subsidy of the total cost, establishing the standard specifications and technical guidance, and drawing up the Ten-Year National Land Survey Plan.

The cadastral survey consists of the following stages; supplementary survey, detailed on-the-spot survey, measuring the area of each parcel, and making maps and books. The supplementary survey comprises the control point survey which is to set up control points for cadastral surveying. The establishment of 4th grade triangulation points is carried out by GSI. At the stage of the detailed on-the-spot survey, all boundaries are confirmed by presence of land owners, and piles are putted on the boundary corner points. The area of each parcel is calculated from the coordinates of corner points.

The scale of cadastral maps and the required accuracy of measurement are decided based on the land use of survey area. The scales of 1:250 and 1:500 are commonly used in urban area.

The results of cadastral survey are sent to registry offices after the check of MLIT, and the registry offices update the cadastres and land registries based on the result.

The progress of cadastral survey at the end of FY2008 is as follows:

Completed cadastral survey: 138,385 km^2 (1951-2008)
Progress ratio: 48% (Target area of the survey: 286,200 km^2)

Ministry of Agriculture, Forestry and Fisheries (MAFF)

1. Large Scale Topographic Maps

The Forestry Agency began a nationwide project in mountainous areas for the purpose of elaborating Basic Forest Maps (BFMs) as the basis for forest planning in accordance with the Forest Act in 1939. The project covering mountainous areas was completed in 1980. Currently the Forestry Agency and the Prefectural Governments are carrying out revision work of the existing Basic Forest Maps.

Forest Planning Maps, with forest inventory information attached on BFMs, are prepared on a scale of 1:5,000 for all forest areas which account for 66% of the total landmass and are updated at least every five years. Since most of the Forest

Planning Maps are digitized, the Forestry Agency and forest sections in the local governments are operating Forest GIS (Geographic Information System) and digital mapping work of Forest Planning Maps for national forests and private forests respectively aiming for better integrated forest management. Table 8 shows the basic forest mapping work during the same period.

Table 8. Basic Forest Mapping

Title	2006	2007	2008	2009
1:5,000 Photomaps	496km^2	916km^2	927km^2	915km^2
1:5,000 BFM Revision	777km^2	1,128km^2	1,232km^2	809km^2

2. Soil Maps

Soil maps in Japan are roughly divided into two categories; for cultivated lands and for forest lands. They are prepared by the Ministry of Agriculture, Forestry and Fisheries.

A 1:50,000 scale map series of soil types and productivity of cultivated lands has been prepared by the Agricultural Production Bureau since 1959, and the entire area of cultivated land, 51,000 km^2 in all, is covered.

A 1:20,000 or a 1:50,000 scale map series of soil types in national forests has been prepared by the Forestry Agency since 1947. 65,000 km^2 have been covered by this series. A 1:50,000 scale map series of soil types for many private forests has been elaborated as well.

Geological Survey of Japan / National Institute of Advanced Industrial Science and Technology (GSJ/AIST)

1. Geological Maps

GSJ/AIST has been publishing most of geological maps in Japan. A series of basic geological maps from GSJ/AIST is prepared on the scale of 1:50,000 (1:75,000 before 1952) and 1:200,000. The coverage will become 74.3% (947 sheets of 1274) at the scale of 1:50,000 (including covering areas of 1:75000) and 100% (124 sheets) at the scale of 1:200,000 until the end of 2009.

GSJ/AIST has also been engaged in marine geological and geophysical surveys of offshore areas of Japan. The results of surveys have been published as "Marine Geology Map" series which include geological maps and sedimentological maps since 1975. These series have been published on CD-ROM since 2002.

Table.9 Numbers of Geological Maps

Map Series	scale	before 2006	2007-2009
Geological Map	1:200,000	112	12
	1:50,000	936	11
	< 1:500,000	20	-
Marine Geological Map	Geological 1:200,000	26	6
	Sedimentological 1:200,000	22	4
	< 1:1,000,000	9	-

2. Geodetic Map

GSJ/AIST has been conducting gravity surveys and high-resolution aeromagnetic surveys at the onshore and offshore areas of Japan. The results have been published as the "Gravity Map Series" and the "Aeromagnetic Map Series" since 1972. Gravity data in offshore areas have been published as the appendices of "Marine Geology Map". Recent target areas of high-resolution aeromagnetic survey are mostly related to the elucidation of active volcanoes or active fault system. The high-resolution aeromagnetic map of "Iwate Volcano(1:25,000)" is the recent publication in the aeromagnetic map series.

Table.10 Numbers of Gravity Maps and Geomagnetic Maps

Map Series	scale	1972-2006	2007-2009
Gravity Map (Bouguer Anomaly Map)	1:200,000	24	3
	others	3	-
Aeromagnetic Map	1:200,000	33	-
	> 1:100,000	8	1
	< 1:500,000	2	-
Digital Data(CD-ROM)		2	-

3. Other Maps

Several thematic geological map series and digital geoscience maps (CD-ROM) are also major publications from GSJ

Table11. Numbers of thematic geological maps and digital geoscience maps

Map Series	- 2006	2007-2009
Geological Map of Volcano	13	3
Strip Map of Active Faults and Neotectonic Map	14	-
Water Environment Map(inc. Hydrogeology Map)	45	2
Mineral Resources Map (1:500,000)	7	-
Geological Map of Coal Fields and Oil & Gas Fields	29	-
Oversea Geoscience Map	12	4
Miscellaneous Map	38	2
Digital Geoscience Map	31	11

GSJ/AIST Homepage: http://www.gsj.jp/HomePage.html
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